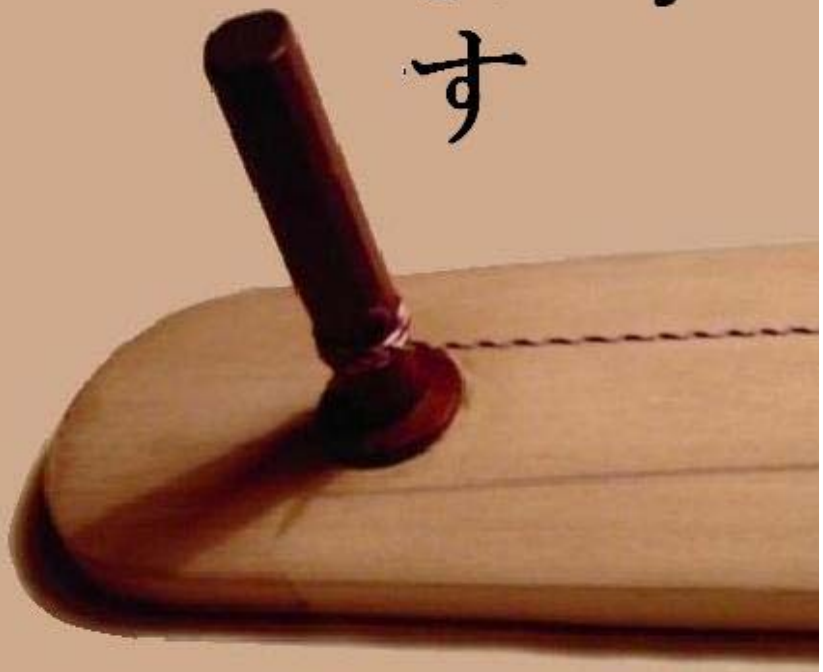
The Ichigenkin: Making My Own

一絃琴 私の作ります



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Open Source Publication

Inside Front Cover

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Making My Own

Introduction

I'm writing this for anyone who might be interested in owning their own ichigenkin, and like me, cannot afford to get one from Japan. It might be an interesting proposition to revitalize the versatility of this instrument and bring it out of ancient obscurity into new light as an instrument for modern innovative music. Since I can't pop over to Japan and pick one up, I've decided to return to the concept of "if you can't buy one, why not make one for yourself?!"

When I was in college, I acquired an album of Japanese music that was entitled "Koto: Music of the One String Ichigenkin," (Isshi Yamada: Ichigenkin and Fuzan Sato: Shakuhachi, Folkways Records, 1968). I thought it might be similar to the music of the thirteen stringed koto (that I had grown to love and was well known at that time), but when I got it home I heard a treasure of beauty and simplicity that gave me a new love. The photography on the album didn't show much of the instrument, but I wanted to learn more. All I found was a very simple line drawing in an encyclopedia with not a lot of information, and gave up trying to learn much more with the limited resources of the time.

Originally the ichigenkin was played by scholars, samurai and zen priests, who considered the instrument as a means of self improvement. Much like ikebana (flower arranging), and chadou (tea ceremony), playing ichigenkin was considered a martial art, and practice was considered a form spiritual training. It wasn't a major performance instrument. Now, it is mainly played by women (though a few men are also finding it compelling) as a source of self expression. Still, it

carries with it considerable potential for adaptation to a more modern audience, while keeping its cultural ambiance.

In recent years with the blossoming of the web, much more information became available online. There are resources on YouTube that show people playing the ichigenkin and a web site or two with information about it.

I began by gathering as many photographs and as much information as I could. One of the photographs from the Metropolitan Museum of Art was captioned with rudimentary measurements which I applied to the many photographs and I found numerous variations from photo to photo. All of the photos were taken from the top and the sides, or at oblique angles, and vital information was missing, especially concerning the underside. So, I wrote to the Contact at Ichigenkin.com, and received the following information:

> There are ichigenkin for purchase, but they start at approximately $1000US, and must be sent from Japan and pre-ordered.
>
> However if you can make one or get an instrument maker to make one, then you might fulfill a demand for them in the west, which is small but continuous.
>
> Here are details on a common size for ichigenkin:
> length: 110 cm.
> Width 13 centimeter at bridge end tapering to 9 centimeter at peg end
> wood thickness: 1.5 centimeter
> instrument has convex curve lengthways and by width both of .5 centimeter at greatest height.
> center of Peg from end: 9cm
> stringhole from end: 8cm
> Back of bridge from end: 10cm
> bridge is 1.75 centimeter x 1.5 centimeter and is 2cm in height
> foot is 1,5 centimeter x 1.5 centimeter x width of instrument.
> some instruments have a .25 centimeter x .25 lip on the underside.
> cutaways signify which school the instrument belongs to, and therefore vary in position and size

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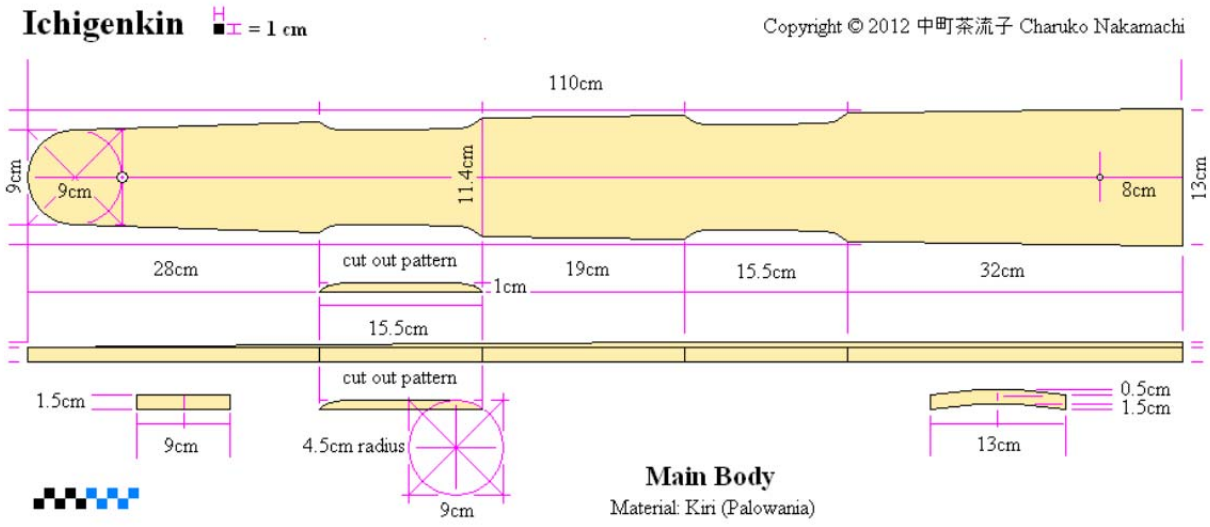
Making My Own

Making my own is enough, and I'm not sure that I would like to start a business of ichigenkin making, but documenting my efforts might create a guide for anyone else to make their own, and maybe, inspire someone interested enough to become an American source for people interested in buying an ichigenkin.

From the information that I received, I created a plan drawing for building my own:



I chose to use a form that is played in Kochi Prefecture, Shikoku, Japan. In creating these plans, I noticed that the sound board in the photographs tended to have an angle of one degree off from ninety at the rectangular end on each side, but this taken all the way to the round end made the round end to be more than nine centimeters wide. So I kept the one degree off of ninety to the beginning of the cutouts near the round end (66.5 centimeters from the rectangular end, where the width became 11.4 centimeters) and then varied the angles until they gave the nine centimeter width at the round end. This should increase the sound board surface and add to its

resonance. When laying out a paper pattern, following the plan drawing should provide the proper dimensions.

The wood from which an ichigenkin is made is most often Kiri (Paulownia) or alternately Sugi (Japanese Cedar). Native to Asia, the *Paulownia tomentosa* variety of kiri is considered an invasive species in the United States, but it's a very versatile wood, and if it's a problem species in my country, I rather think that it would be a great way to bring it under control by harvesting it and putting it to use where other woods are being overharvested. I found only two places that offer it for sale, one of which went under shortly after I ordered some stock from them. They delivered a smoothly planed board which I decided to set aside simply because it just has a very nice quality by itself and I wanted to save it for the future. The other distributor sent me a rough cut board of the same size from which I've begun my project.

I'm not going to make my ichigenkin particularly elaborate. I want create a simple basic instrument that anyone can duplicate. If you want to embellish or improve on what I do, all the better. It's mostly about making something and enjoying doing it.

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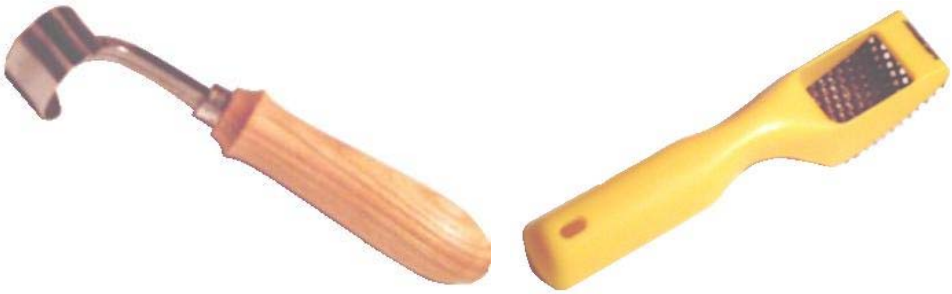
Making the Sound Board

Kiri is a very light weight wood that feels a bit like balsa, but is much stronger and more resonant. It's worked as easily as pine or fir, but has a finer quality than these two woods. I began by cutting out the basic shape at the table saw, refining the rounded end with a coping saw, and then working the top down to its curved shape with a block plane, a plane rasp and sandpaper. Yes, these are the actual tools that I used, the coping saw, a very cheaply made block plane that looks like a child's toy (but isn't), and a basic plane rasp:

My spouse and I sanded the surface with sandpaper grits starting with 60, then 150, and finally 220. We first used the 60 grit to do the final shaping that the plane and rasp were too coarse to achieve. Then, we progressively employed the 150 grit and then the 220 grit to make the surface smooth. The side cutouts were left until all the rest of the shaping was completed as they may tend to make shaping the underside more difficult.

Now for the underside, I was concerned that the instrument might require something on the order of a base bar to distribute the sound, but using a tuning fork, I tested the resonance and concluded that this may be unnecessary as the sound seems to distribute through the wood quite

easily. The vibrations of an A220 tuning fork held at one end can be felt vibrating with the fingertips at the other while the sound is quite audible, and as the wood is thinned the vibrations become stronger. So, my decision was to simply hollow the back until a consistent thickness of 1.5 centimeters is created throughout the instrument. This can be accomplished with a scorp, a curved rasp, and the same 60, 150, and 220 sandpaper as used on the upper surface.



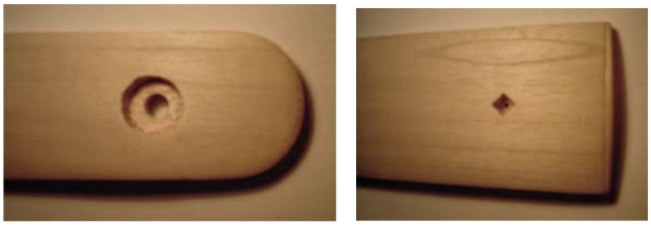
To check the thickness of the wood I needed calipers. Not having them, I improvised with two scraps of wood, a pair of used disposable bamboo chopsticks and a bolt. You don't have to always go out and buy a bunch of tools if you think creatively about the things you have on hand. With these homemade calipers, I was able to keep the thickness to 1.5 centimeters.

Differences that I've incorporated are a thin strip of kiri veneered to the round end for reinforcement of the end grain and I've attached an end piece of kiri to the rectangular end to give it a cleaner finish.

In order to curve the veneer strip, I thinned the wood to about a millimeter, and soaked it in boiling water for about twenty minutes. Then I formed it over the round end of the instrument holding it in place with rubber bands until it dried. Marking the ends of the veneer strip on the instrument, I then shaved a small amount off the straight portions of the mounting area to take the veneer, and glued the veneer in place securing it tightly until the glue set. Any minor gaps were filled with small bits of wood shavings and wood dust. As there were few of these, and after sanding the edges of the veneer flush with the surfaces, the veneer blended with the wood and created a strong protective finish to the round end of the instrument.

The cap for the rectangular end was cut to cover the end grain and attached with glue after the underside was formed into its final concave shape. The bottom edge of this end piece was aligned straight across from one bottom edge of the instrument to the other, and the sides and top were sanded flush with the rest of the instrument.

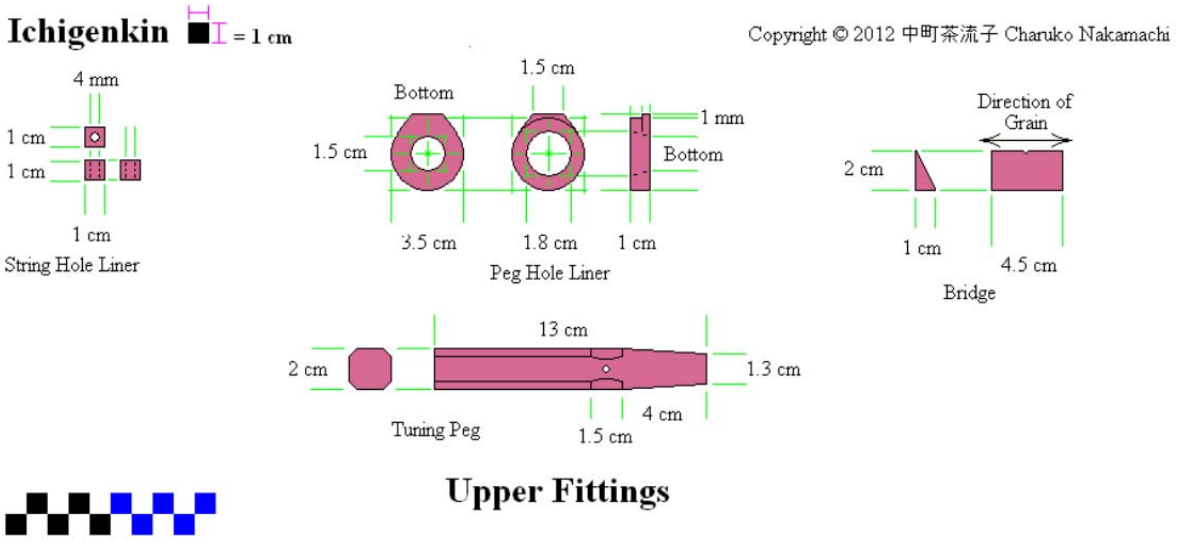
Finally, come the cut outs on each side. Each is no more than 1 centimeter deep and cut with a coping saw. I shaped each with a shoe rasp, and the series of sand paper grits. Then with a power drill, a rat tail rasp and some old cheap carving tools, I drilled holes and carved out places to take the peg hole liner and string hole liner.



Upper Fittings

For the string fittings (the peg, the peg hole liner, the bridge and, the string hole liner) and the underside fittings (the foot and under peg riser), I've incorporated purpleheart as it's a very strong hardwood, has a beautiful contrast to the kiri and I happen to have it on hand. In the photographs it seemed that different woods other than kiri were used here to provide greater stability for the string. It's an assumption, and purpleheart may be a non-traditional wood, but it seemed appropriate for the purpose and I'm not letting what I have go to waste. Purpleheart is

an exotic hardwood, and controversial depending upon how it's managed or harvested. Overharvesting has endangered some species, so it's important to know your source. A dense hardwood like purpleheart or ebony solves compression problems in a wood such as kiri because it can be used to defuse the stress over a wider area. Kiri, while resistant to breakage, is easily compressed and cut. Using a denser wood to line the peg hole and the string hole prevents the Kiri from being torn or distorted by the tension of the string at those points of contact.



String Hole Liner

The string hole liner is a simple 1 centimeter cube with a hole drilled through the center. The edges of the hole are rounded and smoothed over to protect the string from binding or breaking.

Peg Hole Liner

The peg hole liner is a 3.5 centimeter ring with a tapered hole through the middle and a flange on one side to lock it into place when glued into the ichigenkin body. The hole carved into the kiri has a slot carved into it to receive the flange. This slot is cut into the hole opposite to the string preventing the peg liner from being pulled out by the tension of the string.

Tuning Peg

The tuning peg is 13 centimeters long and tapered at one end. The schematic shows how I shaped the peg for my instrument and except for the taper there is room for design flexibility. The taper of the peg and the taper of the peg hole liner are angled to match. I kept my peg simple but you can be as decorative as you want.

Bridge

The bridge is one area where there is a wide variance in form, except in terms of height and position. For mine, I used a very basic design. I also incorporate a form that is a right angle triangle from the side and rectangular from the front. For easier fitting to the curved surface of the ichigenkin, I had to file the bottom surface a little bit at a time to make it fit as perfectly as possible. It should be curved to perfectly match the surface on which it will sit under the tension if the string. The grain of the wood is horizontal to prevent the string from splitting the bridge. A very small notch in the middle of the top edge is cut and smoothed to keep the string aligned. I also installed two small wedges of purpleheart on the kiri sound board to mark the position of the bridge and keep it from slipping out of position.

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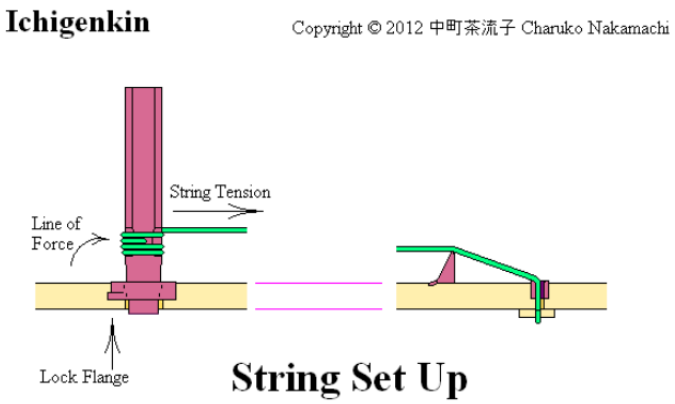
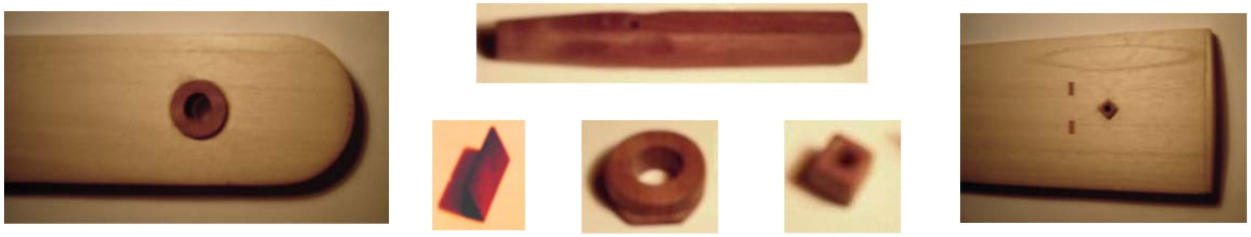
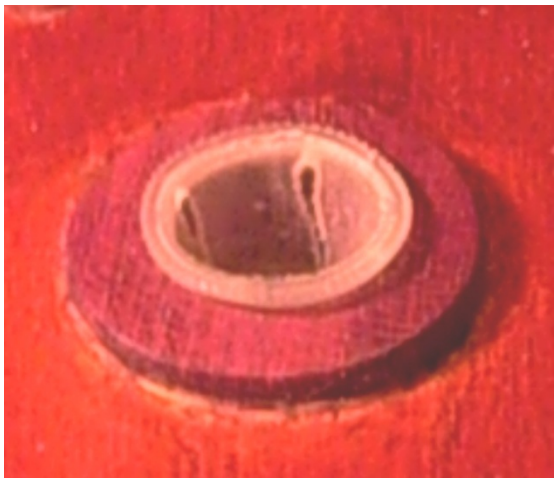




The peg must be able to hold the string under tension and therefore needs to grip the peg hole firmly against the tension of the string. Because the hardwood of the peg and the peg hole liner is the same, it won't hold the tension because it has nothing to grip. The hole needs a liner that's softer than the hardwood.

I tried lining it with a strip of cardstock, but I wanted something more permanent. So, I tried lining it with bits of kiri left over from the side cutouts and cut thin pieces across the grain. The kiri and the card stock worked when they were wet, but dried out they wouldn't hold the tension.

Finally, I came to the idea of using a plastic liner, preferably with a flange at the top to keep it from slipping through the hole. For this I used a small plastic spool for sewing thread which I cut in half, removed the inner core, and cut slots in the sides to help it to take the taper of the hole and peg.



I figured this out after I finished the ichigenkin. A project like this often takes a lot of experimentation, and it isn't always a linear process. If you think of something that will work better, there's nothing wrong with making modifications.

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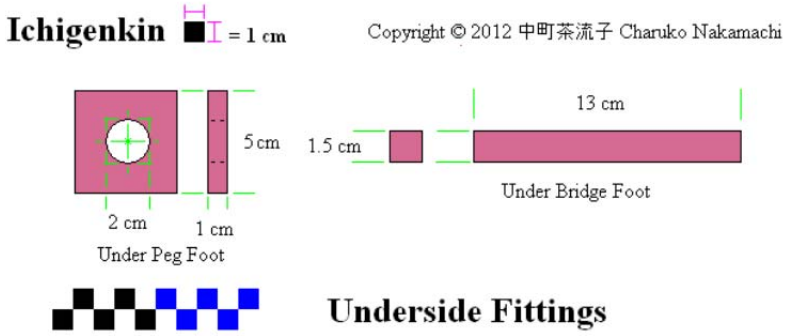
Underside Fittings

The underside has a 13 by 1.5 by 1.5 centimeter foot that sits under the string hole or bridge, and from the photographs seems to have a riser block under the peg. For these, I cut the following and attached them as shown.



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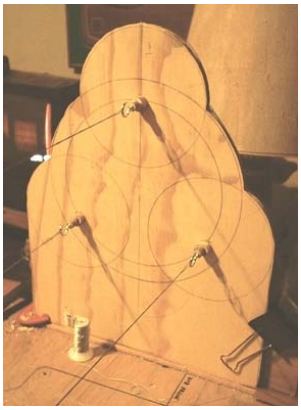
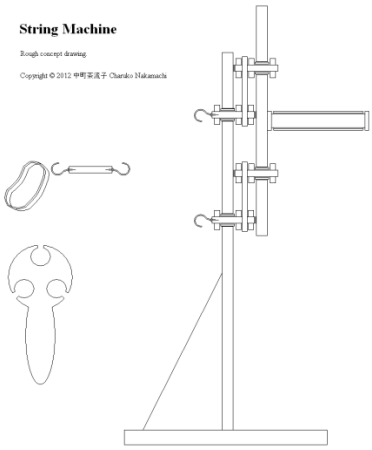
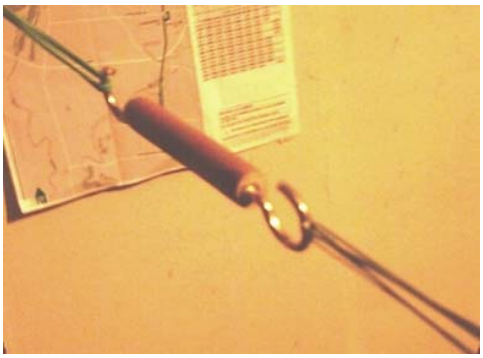
The String

The string is silk. For mine I plied 12 threads (three plies of four threads each) of Gudbrod Champion Silk E H33 (pale green or peridot beading thread) together to make a string of suitable thickness. To do this I built a small "rope making machine," numerous plans for which can be found with a web search for "rope making," so I won't duplicate them here, but here's the one that I made:







I chose Gudbrod because they have a good quality product and in the traditional green color that I wanted. (I'm using a purple and white string in most of the photographs here because it's what I had before I could make the proper string, but it's the same silk.) There are other silk threads available if Gudbrod isn't to your liking,

Gudebrod Silk Beading Cord, Pale Green H33, Size #E, (.0128mm), 200 yd spool (1/2 ounce), (1 spool)

To hold the string in place at the bridge end, place the string through the string hole, and secure it under the sound board with a small section cut from a single use bamboo chop stick, tying it with two half hitches.

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The Rokan

For the rokan, the two tubes used to play the ichigenkin, traditional ivory is no longer appropriate (or legal) to obtain. An image of an ivory set can be found at http://www.leejisun.com/JM-instruments.htm (number 19 on the page). Other materials are now required for use.

An image that includes a bamboo set of rokan pictured with an ichigenkin can be found at: http://www.museumofmakingmusic.org/slide/world1.html.

I suggest experimentation here. Different materials may have different effects. The only caution is to make sure the material is smooth and won't cut or bind on the string. Otherwise, you'll be spending a lot of time making and replacing strings.

Dimensions of the ivory set appear to have an external diameter about 3.5 to 4 centimeter for both with a 1.5 to 2 centimeter internal diameter to comfortably, but firmly fit your finger. Lengths from the top of the diagonal cut are approximately 7.5 centimeters for the larger, and 5.5 centimeters for the smaller with the diagonal of something approaching 22.5 degrees. I settled on this angle because most mitre boxes already have slits for cutting at 22.5 degrees.

Materials to try should be have properties close to ivory. Properties of ivory include:

Crystal system: none, amorphous

Refractive Index: 1.54

Hardness: 2.5 - 2.75 (Mohs scale)

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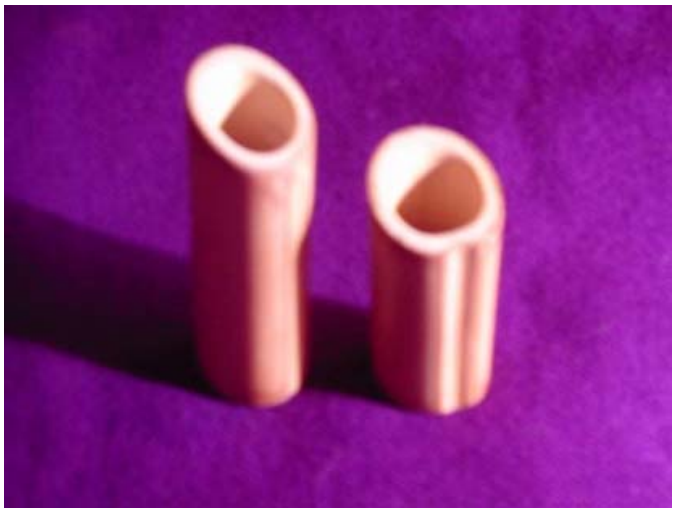
Toughness: fair

Specific Gravity: 1.70 - 2.0

Cleavage: none

Luster: greasy

Duplication of these properties can be found in substitute materials. A beef femur from your butcher can provide a fair bone substitute though a little on the hard side, but plastics such as PVC may provide a closer analogue to ivory and be closer in hardness (similar to the hardness of a finger nail and only slightly softer than ivory), and a PVC pipe could be just what is needed. Ivory and bamboo are natural tubes which can easily be formed into rokan, so using something already formed into a tube that can easily and comfortably fit over your finger will make reasonable rokan. The rokan for producing the notes is about 7.5 centimeters on its tall side (remember that the top is cut at a 22.5 degree angle), and the rokan for plucking the string is about 5.5 centimeters on the tall side. When finishing the rokan, be sure that all the surfaces are smooth and polished so the string doesn't catch and tear. I've decided to use bamboo and made the angled cuts near the nodes to take advantage of the taper of the interior diameter.



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Tuning

For tuning and for marking notes on the sound board, I decided to stay with Japanese pentatonic musical tradition. For a more Western musical format, any musical scale may be used.

Tuning the ichigenkin presents some inherent problems when there are only recorded performances from which to learn. Traditional Japanese music uses a variety of pentatonic scales, but is still compatible with Pythagorean tonal qualities. Analyzing videos of ichigenkin performances, and isolating the open string (lowest) note I compared tones using tone analysis software such as the Audacity (free digital audio editor), and Mozart Music Processor (available as shareware license purchase required).

Analyzing video of ichigenkin music, I settled on a basic A110 tuning of the open string. This is an estimate, but it gave me a basis from which I could mark out notes on the surface of the sound board.

On the top surface of the ichigenkin there are decorative markings that correspond to frets, visually marking out the positions of certain notes. Find the exact center of the string's length, and you find a note one octave above the open string. From this point other notes can be marked out. Analyzing photographs for common marking patterns helps, but there are major variations in the photographs. It's better to listen to the music and find the corresponding notes on your own ichigenkin.

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Working with one clear image, and experimenting with the proportions between markings shown, a comparison of the musical intervals with the scales should help to mark out where the note should be. Then, decorative markings can be inlaid on the surface using a material of contrasting colour. I used slices cut from cherry, mahogany, and purpleheart dowels (about a half centimeter in diameter).

Making temporary light pencil marks that can be adjusted before setting the inlays will insure accuracy. I do not suggest marking out measurements without fine tuning them by listening to the tones produced at each point. Simply working from a photograph will incorporate errors caused by angular distortions inherent in whatever photograph you might choose to use.

1. The first note to mark is equidistant between the bridge and the point where the string leaves the peg surface. This point should give a clear octave from the open string, and will serve as a reference point for other notes.
2. A point equidistant between this point and the bridge will mark a note one octave higher. Traditionally, there aren't any notes marked higher than this.
3. Between these two octave notes is a third note marked out roughly equidistantly, but will require adjustment.
4. A note one musical step up (remember this is pentatonic) from the peg is the next to mark.
5. In the upper octave work out the positions of the pentatonic notes, then use this scale to work out the lower notes.

These are two examples of Japanese musical scales starting on A220:

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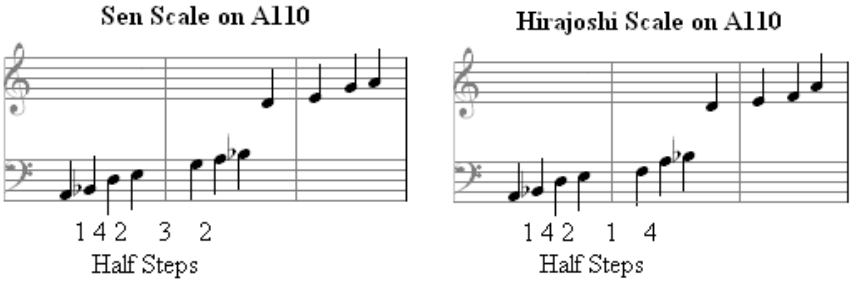
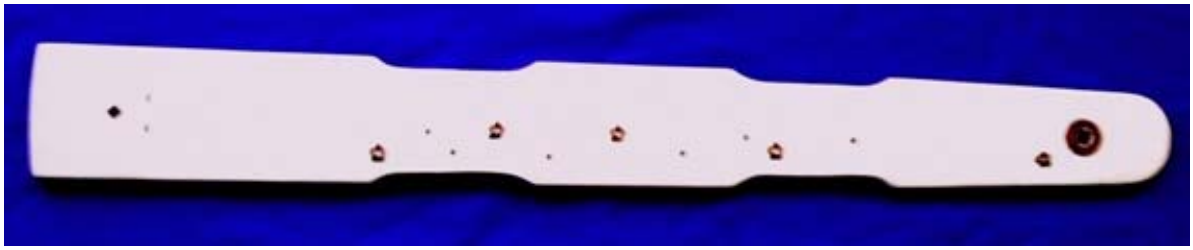


In Japanese music, the middle note of the scale is considered its root (as opposed to the first note in Western music). So, the octaves and half octaves are marked with prominent inlayed decorations. The remaining notes are marked with smaller inlays. It's better to do this proportionally and by ear than to measure them out with a ruler. This insures that the tuning will be correct. Here is how my completed note position marks look:



These may be off, so don't rely upon them, just use then as guide posts and fine tune for yourself. If you are making your own ichigenkin don't rely upon my measurements. The best guide is your ear. Listen to the notes and be sure that they are where you want them to be before you make any permanent markings on your instrument.

Finishing the Wood

Test your finish on a bit of scrap kiri to be sure that it's what you want. Japanese originals come in a variety of colours, so yours is the choice.

The only surface treatment that I've given the purpleheart is an olive oil and beeswax finish. The peg was left unfinished and un-treated where it enters the peg hole liner as is the inner surface of the hole to prevent impedance of the gripping function of the peg. Taping off the purpleheart with painter's masking tape, the upper surface and sides of the kiri sound board is finished with a vinyl sealer followed by ten light coats of luthier's acoustical lacquer. A light sanding with 600 grit sand paper between each coat, and a final polish with the oil and beeswax mixture brings up a fine surface. The underside surface is left unfinished except for the vinyl sealer.

Staining the wood is a personal choice. I've seen some that are stained quite dark, almost black, and some that are kept light in colour. Most are brown, and for many an under lacquer stain creates some striking contrasts in the grain of the wood. I decided not to stain the wood directly, but I have used an amber coloured lacquer for the first five coats and a clear lacquer for the five remaining coats. This has given the finish a rich red amber tone similar to a violin that adds depth to the kiri. After a cure time of at least a week after the final absence of any volatile smell from the finish (the longer the better), a polish of the olive oil and beeswax or a commercial musical instrument surface wax will help protect the lacquer. Before finally fitting the bridge, the lacquer must be fully cured and the wax must be applied to prevent the bridge from sticking to the lacquer. The bridge sits on the soundboard rather than being permanently attached.

The polish is simply a one to one mixture of olive oil and melted beeswax. When it cools it partially solidifies into a spreadable wax that can be applied with a small soft cloth. I poured mine into a couple of empty makeup blush boxes and cut out small flannel patches to use as applicators.

A thin application, buffed to a shine will harden into a protective coating over the lacquer.

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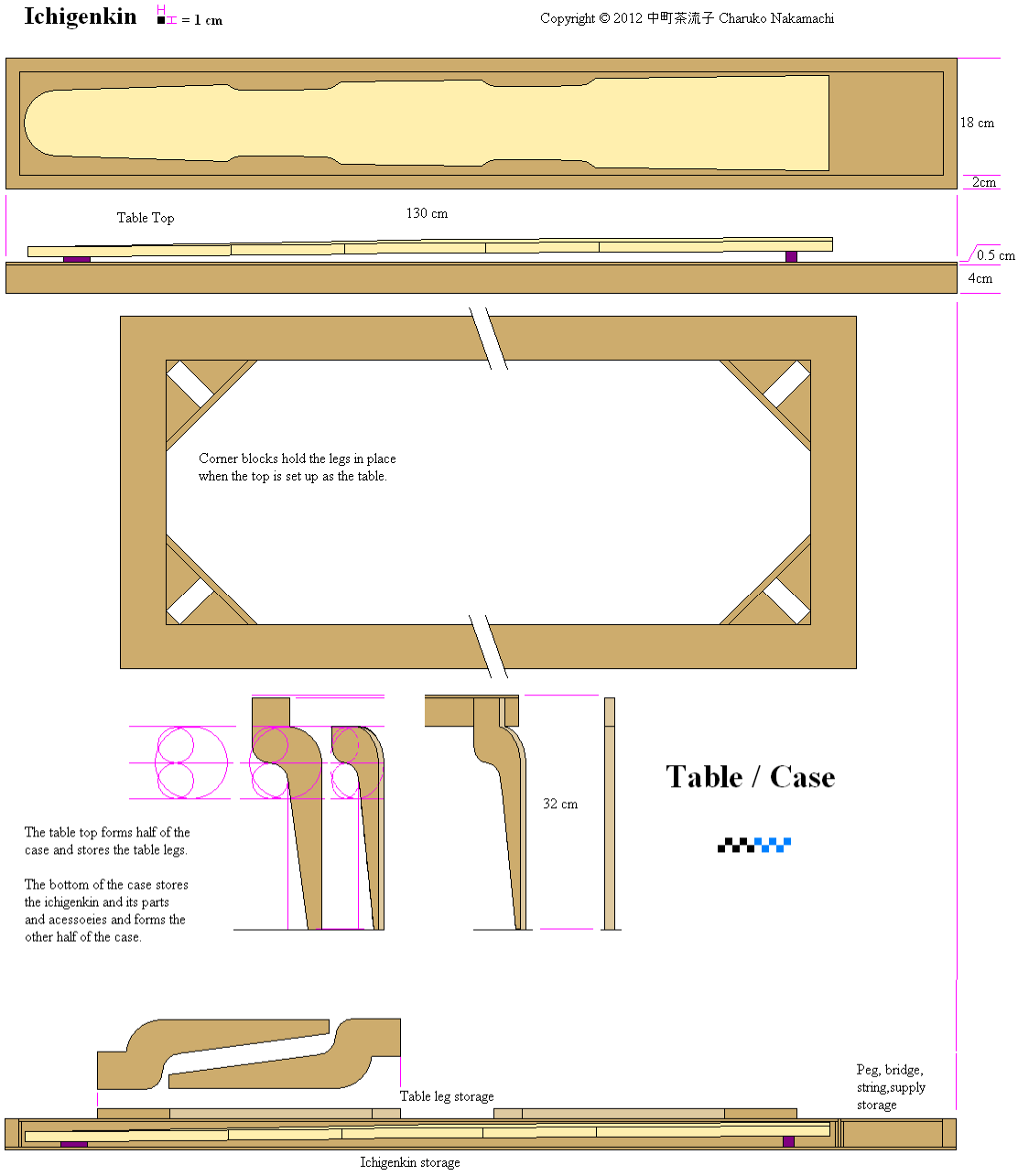
Next Step

My next step is to build a table for my ichigenkin so I can have a place to put it while I play it. It should have a fairly thin top to help amplify the sound and fold up into a case for the instrument. Of course, this is another project!



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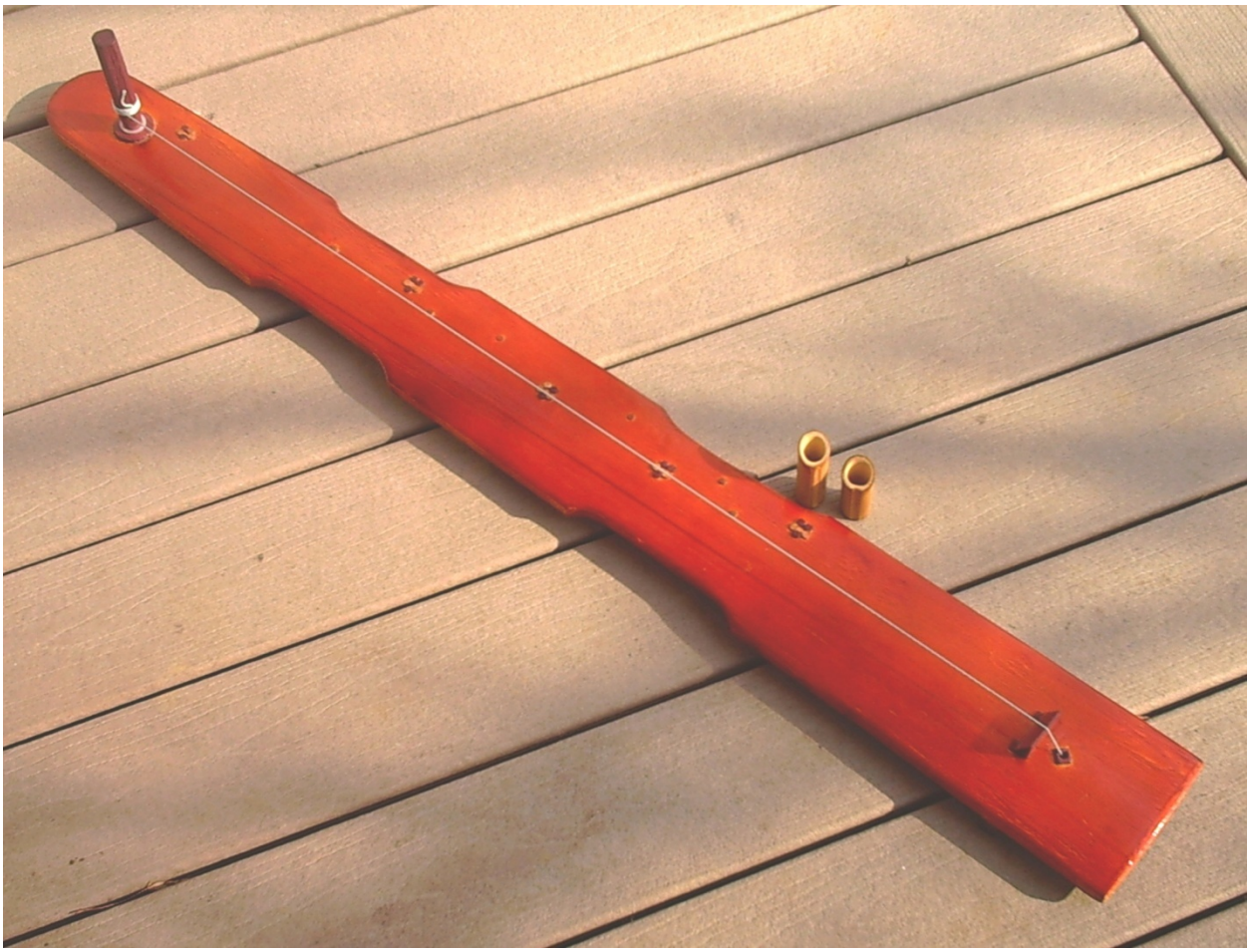
My Final Results

My finished ichigenkin looks like this:



Innovation

I've stayed as close to tradition as I could discern it from the resources available to me. Some is supposition, but most is from clear observation. Personally, I prefer classical forms of music from any cultural tradition. This doesn't mean that everyone need do the same. Bringing experimentation into the process is the key. By this, I mean it would be good to consider where such an instrument would have evolved if it had not been almost lost to history. What if it was made of more modern, more resonant materials? What if it was amplified like an electric guitar? What if Heavy Metal rock music had discovered the ichigenkin, or if it had become a primary instrument of Techno Pop or Hip Hop? What if it had evolved in Appalachia and become part of Blue Grass or came to New Orleans and adapted to Jazz? What if Mozart had somehow found and started composing for an Ichigenkin? In the many worlds, magnificent potential presents itself for innovation. Playing a musical instrument and experimenting with its potential is what keeps an instrument alive and what helps it evolve with musical tradition. It also makes music evolve in turn. The loss of an instrument is the loss of a line of musical evolution. I'm an environmental designer. As such I use a combinatoric approach to bringing together new processes and new concepts from completely separate and divergent fields for the improvement of life. It's a matter of thinking in a non-linear fashion and looking for new ideas and opportunities growing out of formerly average concepts. This is an opportunity.

You the reader of this text may just be the one to bring this amazing instrument to new levels of expression and innovation. Build one for yourself. Improve upon its design and play with it. Play with its effects and see where you can take it and where it can take you.

The Ichigenkin

Making My Own

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For specific images of ichigenkin other than mine, a web search using the key word “ichigenkin” should provide numerous examples. Out of respect for the intellectual property rights of the owners of those images that I used for measurement purposes, I will not reproduce them in this report, but will leave such measurement comparisons to the individual craftsman.

Most of the photographs in this report were taken with a Polaroid a500 Digital Camera, 5.1 mega pixels. Others were taken with a Vivitar DVR-310 MPEG4 Digital Video Recorder.

Inside Back Cover

Originally the ichigenkin was played by scholars, samurai and zen priests, who considered the instrument as a means of self improvement. Much like ikebana (flower arranging), and chadou (tea ceremony), playing ichigenkin was considered a martial art, and practice was considered a form spiritual training.

This is how I made my own

Ichigenkin

Charuko Nakamachi